305 PIPE WATER MAIN - DUCTILE-IRON

305.01 DESCRIPTION

Work consists of furnishing and placing water main pipe, fittings and specials including pipe for suction blow-offs and fire hydrants, jointing and harnessing, cutting and connecting to existing system, including additional fittings not shown in the Contract Documents or anticipated in the work and requisite retainer glands; reconnecting existing mains, testing operations, and incidental work needed for a complete installation.

The District reserves the right to furnish any additional fittings required to complete the Contract in a timely manner and in the District's interest.

Water main pipe 48-inches and smaller diameter shall be ductile-iron pipe unless otherwise specified.

Water main pipe 12-inches and smaller diameter shall be harnessed at all joints.

When a water main is attached to a bridge or other structure, work includes all pipe supporting members such as cross beams (other than diaphragms), rollers, hangers, connecting hardware, PCC inserts, expansion devices, and appurtenances.

Trench excavation and fill are not part of work; see 207.

Valves and fire hydrants are not part of work; see 306 and 307.

Valve casings are not part of work; see 302.

305.02 SUBMITTALS

Shop drawings per 105.02 shall be submitted for pipe laying schedule, closure pieces, fittings, specials, joint details, bevel pipe, restraint and harnessing, special designs.

Mechanical and push-on joint restraint methods, including pressure rating from manufacturer, shall be submitted by the Contractor and approved prior to material order or installation.

Data, affidavits and certifications shall be submitted per referenced AWWA specifications and this Section.

305.03 MATERIALS

Ductile Iron Pipe and Fittings - 809.01

Coating/Lining for Couplings and Connections - AWWA C 203 and AWWA C 104.

305.04 MATERIALS SUPPLIED BY DISTRICT

Corporation stops for dead end and air blowoffs 2-inches and smaller in diameter will be furnished by the District at no cost to the Contractor.

District supplied materials will be furnished at the Bureau of Water Services property yard. These materials will be loaded on the Contractor's trucks by District forces between 7:30 a.m. and 4:00 p.m., Monday through Friday. The Contractor shall haul and install these materials as directed. Damages and/or

loss shall be at the Contractor's expense.

Material supplied by the District requires a purchase requisition furnished by the Engineer and signed by an authorized representative of the Water and Sewer Utility Administration.

305.05 CONSTRUCTION REQUIREMENTS

(A) GENERAL. Pipe delivery and distribution shall be scheduled to provide minimum interference with required maintenance of traffic. Pipe delivery shall be coordinated with pipe installation as directed.

Pipe shall be distributed along the line of work and outside the trench as near as practicable to point of placement, facing in the proper direction and properly wedged secure. Pipe shall not be rolled or dragged on the ground. No pipe shall be placed against trees or shrubs nor in a manner that may damage private and other property.

Proper measures shall be taken to protect pipe, pipe coating and lining, fittings and appurtenances from injury at all times. No material shall be deposited on or against pipe. Skids and wedges shall be arranged and installed to prevent injury of any kind. Suitable approved tools and equipment shall be used for convenient and safe handling of pipe and fittings.

Prior to placing pipe and fittings in the trench, the interior and exterior of pipe and fittings will be inspected by the Engineer. Pipe or fittings damaged beyond acceptable repair will be rejected and shall be removed and replaced at no cost to the District. Chipped, cracked, scarred or otherwise injured outer coatings on ductile-iron pipe shall be properly repaired as directed at the Contractor's expense.

Just prior to placement, the inside of all pipe and fittings and the ends of outside surfaces shall be thoroughly cleaned; interior surfaces shall be kept clean throughout construction by use of carefully fitted stoppers. When pipe installation is not actually in progress, approved watertight plugs or caps shall be placed in all open ends of installed pipe. Surfaces of both pipe sections to be in contact with the rubber gasket seal shall be thoroughly wire brushed to remove all loose rust and foreign matter, leaving clean smooth surfaces for jointing.

Trench excavation and suitable beddings shall be complete to proper grade per 207. before pipe is placed. Any adjustment due to improper trench grade or settlement shall be accomplished at the Contractor's expense. If the pipeline floats or collapses from accumulation of water in the trench or from other causes, approved repair and replacement shall be at no cost to the District.

The Engineer reserves the right to limit the amount of pipe laid in advance of backfilling, but in no case shall the amount exceed 50 linear feet.

Pipe and fittings shall be lowered into trench so ends nearly abut each other. Pipe shall be moved longitudinally in the trench in an approved manner. The entire length of pipe and fittings shall be bedded solidly on the trench bottom to required line and grade. Under no condition shall pipe be subjected to a blow or shock to bring it to the required line and grade.

As part of the work, bell holes shall be excavated to adequate size where needed to accommodate proper joints.

Springing of joints to change direction is prohibited except as indicated in 305.05(D). Otherwise, changes in line shall be formed by beveled pipe, or preformed bend sections of same size and strength as the straight pipe.

Straight pipe shall be furnished in standard uniform lengths. Approved short pipe lengths shall be

used where needed to meet line and grade as closure pieces.

When pipe and fittings require cutting, the Contractor shall take field measurements for making, closing, and connecting pieces of correct dimensions. Cutting shall leave a smooth end.

Wall openings in pipe, fittings or appurtenances for air valve taps will be drilled and tapped by the District for 2-inch diameter Mueller pipe thread and provided with brass plugs after pipe installation.

Access manhole outlets of 20-inch diameter shall be installed where indicated in the contract documents as part of the work and shall terminate with a flange and cover without liner per AWWA C 208. A cover shall be provided with 2-inch diameter Mueller pipe thread tap with brass plug.

After completion of watermain work, unused pipe, fittings and joint restraint pieces, except as provided below, shall remain the property of the Contractor and be removed from the site. No additional compensation will be made.

Fittings and requisite glands shown in the contract documents but not installed due to use of Extra Ductile Iron Fittings shall become District property as determined by the Engineer, and shall be delivered to a designated District pipe storage yard by the Contractor.

(B) MAINTAINING WATER SERVICE. Existing water service shall be maintained at all times except when disconnecting or connecting new work. Existing water mains paralleling new water mains shall be kept in service until new water mains are complete, temporarily capped as needed, tested, chlorinated and charged.

Where an existing water main must be cut and connection made to a new water main, work shall be scheduled as directed to minimize service interruption.

The Contractor shall provide needed facilities and work on a 24 hour basis, at no additional District cost, to transfer water connections, complete connections and abandon old water mains. The Contractor shall notify the Engineer and the Bureau of Water Services for approval at least 48 hours prior to cutting or abandoning a water main.

(C) CUTTING-IN AND REMOVING CONNECTIONS. Unless otherwise indicted, the Contractor shall cut existing water mains, remove pipe, fittings, and appurtenances to make required connections; connect new water mains; reconnect existing water mains; and perform all work necessary or incidental thereto.

(D) JOINTS, DUCTILE-IRON PIPE. Joints shall be assembled per AWWA C 600 to insure tight, flexible joints that safely permit movement caused by expansion and contraction as well as slight ground settling or shifting.

(1) Mechanical Joints. For mechanical joints, contact surfaces shall be cleaned and coated with an approved lubricant just prior to slipping the gasket over plain ends and into sockets. The plain end shall be centrally placed into the socket.

Nominal tee-head bolt torque range shall be as follows:

Bolt Size (inches)	Torque Range (foot-pounds)
5/8	45-60
3/4	75-90

1	100-120
1-¼	120-150

The above torque loads shall be applied with torque measuring or indicating wrenches furnished by the Contractor and witnessed by the Engineer.

When tightening tee-head bolts, it is essential that the gland be brought up toward the pipe flange evenly, maintaining about equal distance between gland and flange face at all points around the socket. This may be achieved by partially tightening bottom bolt first, then top bolt, then side bolts, then remaining bolts. Cycle shall be repeated until all bolts are within required torque range. If an effective seal is not obtained at maximum specified torque, the joint shall be disassembled, cleaned and reassembled at Contractor's expense. Overstressing of bolts is prohibited.

(2) Push-on Joints. For push-on joints, the outside diameter of existing pipe to be joined shall be identical to the outside diameter pipe to be installed. The inside of the socket and the outside of the plain end shall be thoroughly cleaned to remove oil, grit, excess coating and other foreign matter. The circular rubber gasket shall be flexed inward and inserted in the gasket recess of the socket. A thin film of approved gasket lubricant as supplied by the pipe manufacturer shall be applied to either the inside surface of the gasket or to the plain end or both. The pipe plain end shall be entered into the socket with care to keep lubricated surfaces from contacting the ground. The joint shall then be completed by forcing the plain end to the bottom of the socket with an approved forked tool, jack-type tool or other device. Pipe that is not furnished with a depth mark shall be marked before assembly to assure that the plain end is inserted to full depth. Field cut pipe lengths shall be filed or ground to resemble the plain end of pipe as manufactured.

A retainer gland must not be used on any pipe joint connecting ductile-iron pipe to 16-inch and larger diameter existing cast-iron pipe.

After each ductile-iron pipe, fitting and valve are jointed complete, each joint area including restraint elements shall be cleaned and inspected. Bolts, clamps, and all steel parts including thread areas, etc., shall be protected against corrosion using touch-up primer and touch-up coating per AWWA C 203 and approved before the next section is installed. All touch-up shall be complete prior to line tests.

When it is necessary to deflect pipe from a straight line in either the horizontal or vertical plane, the deflection of alignment of the water main at a joint shall not exceed the appropriate permissible offset as specified in Table 305-1.

Unless otherwise specified, the diameter of ductile-iron plain ends shall be the same as for mechanical-joint cast or ductile-iron pipe. For plain ends in proximity to valves, the plain end shall be not less than nine (9) inches from the valve outlet for valves through 24-inch diameter, and not less than 11 inches from the valve outlet for valves larger than 24-inch diameter to accommodate sleeve couplings.

(E) BOSSES DUCTILE-IRON PIPE (30-INCH AND LARGER DIAMETER WATER MAIN). Field installation and protection of bossed outlet pipe and field connections thereto shall be strictly per contract drawings and as recommended by the bossed outlet pipe manufacturer.

TABLE 305-1
PIPE DEFLECTION ALLOWANCES

	Maximum Permissible Offset, In	
Nominal pipe (Size, In.)	Push-On* Joint	Mechanical* Joint

4	19	31
6	19	27
8	19	20
10	19	20
12	19	20
14	11	13-1/2
16	11	13-1/2
18	11	11
20	11	11
24	11	9
30	11	9
36	11	8
42	7-1/2	7-1/2
48	7-1/2	7-1/2

* Maximum permissible offset measured perpendicular to the straight line section at the offset end of 18 foot length of pipe; offset for other lengths shall be in proportion of such lengths to 18 feet.

(F) SLEEVE COUPLINGS. Pipe end condition:

(1) Pipe for use with sleeve couplings shall have plain ends cast or machined at right angles to the pipe axis.

(2) Ductile-iron and cast-iron pipe shall be smooth and round for a distance of eight (8) inches from the end of the pipe up through 24-inch diameter, and for 12 inches from the end of the pipe for pipe larger than 24-inch diameter. The maximum variation from nominal O.D. shall not exceed:

Pipe Size	Variation Max./Min.
3 thru 16-in.	± 0.06 in.
18 thru 24-in.	± 0.08 in.
30 thru 42-in.	± 0.10 in.
48-in.	± 0.12 in.
54 thru 60-in.	± 0.15 in.

The maximum actual O.D. of pipe end shall be such as to permit the passing of a ring gauge having an internal bore not greater than 0.01 inch larger than the nominal O.D. plus the variation maximum indicated above.

(3) Steel pipe larger than 10 3/4 inches O.D. shall be free from indentations, projections or roll marks for a distance of eight (8) inches from the end of the pipe and, within this distance, the actual O.D. shall be not more than 1/32 inch smaller than the nominal O.D. The maximum actual O.D. of the pipe end shall be such as to permit the passing of a ring gauge having an internal bore not greater than 3/32 inch larger than the nominal pipe O.D.

(4) For each type of pipe, the minimum actual O.D. shall be determined by use of a steel tape applied circumferentially to the pipe.

Assembly:

(1) Provide sleeve couplings where shown on the contract drawings. Sleeve couplings without pipe stops shall be used at butterfly valves 16-inch and larger diameter. Couplings shall be of proper sizes for

the valve ends. After assembly, couplings shall be cleaned, primed and coated per AWWA C 203.

(2) Provide additional units as needed for flexibility and convenience for completing installation; locate as directed.

(3) Couplings shall be assembled on the job in a manner to insure permanently tight joints under all reasonable conditions of expansion, contraction, shifting and settlement, unavoidable variations in trench gradient, etc.

(4) Clean all dirt, rust, oil, or loose scale from the pipe end. Check surfaces where the gasket contacts the pipe to insure there are no imperfections such as gouges or grooves that will impair the performance of the gasket seal.

(5) If the shop primer and coal-tar tape wrap on sleeve coupling components are damaged, surfaces shall be field primed and rewrapped before field connection, per AWWA C 203, Section 3. Any damage from field assembly shall be repaired in a similar manner.

(6) Measure back on each pipe end one-half of the middle ring length plus two (2) inches and place a chalk mark to be used for centering the coupling over the joint to be coupled.

(7) Slide follower(s) over pipe end(s).

(8) Wipe gaskets clean and lubricate gaskets, pipe O.D., and middle ring flares with soapy water or a non-petroleum-base lubricant. (Alcohol may be added to soapy water in freezing weather.)

(9) Slide gasket(s) over pipe end(s) and assemble middle ring on one pipe end.

(10) Stab other pipe end into middle ring and center coupling between chalk marks. Pipe end must be past the end of gasket a minimum of one (1) inch after deflection has occurred.

(11) Insert bolts for downstroke tightening where applicable. Bolts on opposite sides of pipe will be in opposite directions.

(12) Tighten bolts on opposite sides, drawing up the followers evenly, until all bolts have been tightened to the recommended torque. Check torque on bolts prior to backfilling.

(13) Recommended torque:

3/8-in. bolts	35 ft. lbs.
1/2-in. bolts	35 ft. lbs.
5/8-in. bolts	75 ft. lbs.
3/4-in. bolts	90 ft. lbs.

(14) Recommended laying deflection per coupling:

	Middle Ring Length		
Pipe Size	5"	7"	10"
1/2" thru 2" O.D.	6 Deg.	6 Deg.	

Above 2" thru 14" O.D.	4 Deg.	4 Deg.	4 Deg.
Above 14" thru 30" O.D.	2 Deg.	4 Deg.	4 Deg.
Above 30" thru 37" O.D.	1-1/2 Deg.	3 Deg.	3-1/2 Deg.
Above 37" thru 42" O.D.		2-1/2 Deg.	3-1/2 Deg.
Above 42" thru 54" O.D.		2 Deg.	3 Deg.

(15) Provide harnessing across all couplings using steel tie rods.

(G) DRAIN BLOWOFFS. Drain blowoffs, exclusive of gate valve, shall be included as part of work and shall be constructed as shown in the contract documents. Unless otherwise directed, the standpipe of the drain blowoff shall be centered in the valve casing.

Gate valves and valve casings shall be included under 306 and 302 respectively.

(H) AIR BLOWOFFS/DEAD END BLOWOFFS. Air and dead end blowoffs shall be included as part of the work and shall be constructed as shown in the contract documents.

Valve casings shall be furnished and installed by the Contractor under 302.

Air blowoff taps will be installed by the District.

(I) JOINT RESTRAINT. All thrust due to expected static and dynamic forces, including water hammer, at bends, tees, wyes, reducers, valves, fire hydrants, drain blowoffs, air blowoffs and dead end blowoffs shall be counteracted by an approved joint restraint method, whether or not indicated in the contract documents.

Ductile-iron retainer glands shall be used to restrain ductile-iron pipe 24-inch and smaller diameter.

For 30-inch and larger diameter ductile-iron pipe restraint, the harness shall be per 809.01(C), and installed per manufacturer's printed instructions. Work includes excavation to accommodate harnessing.

The torque range for retainer gland set screws shall be per manufacturer's recommendations.

The torque range for tie rods and other bolting arrangements shall be per manufacturer's recommendations unless otherwise specified.

All 12-inch and smaller diameter water main fittings including valves and fire hydrants shall be installed using ductile-iron retainer glands instead of standard follower glands.

After each ductile-iron restrained joint is complete, the joint restraint elements shall be cleaned and inspected. Restraint elements of dissimilar materials shall be protected against corrosion using touch-up primer and touch-up coating per AWWA C 203. All touch-up shall be complete prior to line tests.

When shown in the contract documents, pipe, fittings, and valves shall be restrained by concrete thrust blocks. Work includes excavation for thrust block plus concrete and reinforcing steel. If applicable, steel H piles shall be furnished and installed. Measure and payment will be made separately for thrust blocks and H piles.

(J) EXTRA FITTINGS/SPECIALS. Prior to making corrections to existing pipe, for closure sections and for field changes due to unanticipated interferences, the Contractor shall:

(1) Verify the size of existing pipe in service and provide pipe and fittings with sleeve couplings per 809.01(D) to connect to existing pipe or to complete a closure. Limits of pipe and fittings for this purpose shall be approved on detailed drawings submitted by the Contractor to permit closure or to meet fixed outlet points by field alteration of approach lengths to compensate for differences between design and actual laying lengths; and/or

(2) Verify unanticipated interferences and provide additional fittings as needed and as approved on detailed drawings submitted by the Contractor to permit field changes in line and grade needed due to unanticipated obstructions in the actual locations of interfering underground structures or junction water main, including use of additional fittings.

Fittings and adjustments necessary to facilitate closures and proper connections shall be included in the work whether or not indicated in the Contract Documents. Drawings show the more likely arrangement of fittings and specials, but these details cannot be guaranteed due to inevitable field conditions and adjustments.

Where connections to existing pipe, closure sections or unanticipated obstructions require a change in line or grade of proposed water main alignment, Extra Fittings-Contractor Furnished and requisite retainer glands for 24-inch and smaller diameter ductile-iron pipe water main shall be furnished and installed.

For such cases, when in the District's interest and as determined by the Engineer, the District may furnish Extra Fittings including gaskets, retainer glands and incidentals for 24-inch and smaller diameter ductile-iron pipe water main. These items will be furnished, at no cost to the Contractor, for installation by the Contractor.

305.06 WATER MAIN TESTS

(A) GENERAL. After the water main pipe has been installed and while segregated from the system by approved capping or other approved means, it shall be subjected to pressure and leakage tests. Regardless of the length of the water main in the project, all segments shall be tested unless otherwise approved. Contract work shall remain separated from the existing distribution system, except for test connection, until pressure test, leakage test, and chlorination work have been completed.

If the Contractor should choose to have tests conducted prior to backfilling, he shall be responsible for providing and installing temporary blocking to properly restrain pipe.

The Contractor shall provide, install, and remove approved caps and plugs in sections to be tested. Openings in pipe and fittings shall be closed tight to prevent leakage. All temporary plugged and capped ends shall be properly blocked to prevent displacement and leakage. The Contractor shall install a water source connection to the isolated pipe section for test purposes as directed. If a water main tap is approved for a test connection to new water main, the tap will be furnished and installed by the District at no cost to the Contractor.

Incidental pipe connections for tests shall be furnished, installed and operated by the Contractor.

The Contractor shall perform incidental excavation and other work including furnishing incidental materials required for test purposes as part of the work; this shall include any work and material needed for installation and removal of pumps, gauges, meters, and water source connection.

Upon test completion, the Contractor shall remove temporary caps, plugs and other temporary construction and shall complete connections of new work to the system.

All water main test closure materials furnished by the Contractor such as caps, plugs and accessories, provided for water main tests shall become Contractor property upon completion of work.

(B) WORK BY THE DISTRICT. Test pumps, gages, hose, pipe and incidental connections to test and chlorinate new water mains will be furnished, installed and operated by the District at no cost to the Contractor.

The Contractor shall notify the Engineer sufficiently in advance to permit scheduling with work by the District so that no interference nor interruption of work results.

The District will conduct, one each, pressure and leakage tests of new water main, as each test section is ready, without charge to the Contractor. If additional tests are required, all costs of District personnel associated with retesting will be deducted from the Contractor's final payment.

(C) TEST PRESSURES. Test pressures shall be based on the low point elevation in the line or section under test and corrected to the elevation of the test gauge.

Pressure Test (psi) - (R.E.P. - Test Sec. El.) x .433

Leakage Test (psi) - (R.E.L. - Test Sec. El.) x .433 where R.E.P. - Reference Evaluation for Pressure Tests from Table 305.06-1 for service area

R.E.L. = Reference Elevation for Leakage Tests from Table 305.06-1 for service area

Test Sec. El. = Elevation based on the low point elevation in the line or section under test

TABLE 305.06-1
REFERENCE ELEVATIONS FOR PRESSURE AND LEAKAGE TESTS

	WEST OF ANACOSTIA RIVER					EAST OF ANACOSTIA RIVER			
SERVICE AREA	LOW	1ST HIGH	2ND HIGH	3RD HIGH	4TH HIGH	LOW	1ST HIGH	2ND HIGH	
Ref. El. for PRESSURE TESTS (Ft.)	403	481	566	655	716	403	489	613	
Ref. El. for LEAKAGE TESTS (Ft.)	172		250	335	424	485	172	258	382

(D) FIELD PRESSURE TEST. Each segregated section to be tested shall be subjected to a hydrostatic test pressure per subsection (C) as follows:

(1) Pressure Restrictions. Test pressure shall:

(a) Be of at least two hours duration.

(b) Not vary by more than ± 5 psi for the duration of the test.

(2) Pressurization.

(a) Each section of pipe shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to WASUA.

(b) The system shall be allowed to stabilize at the test pressure before conducting the test.

(3) Air Removal.

(a) Before applying the specified test pressure, air shall be expelled completely from the pipe, valves and hydrants. If permanent air valves are not located at all high points, the Contractor shall install corporation cocks at such points so that trapped air can be expelled as the line is filled with water.

(b) After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.

(c) At conclusion of pressure and leakage tests, corporation cocks shall be removed and holes plugged by the Contractor.

(4) Examination. Pipe, fittings, valves, hydrants and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves or hydrants that are discovered following the pressure test shall be repaired or replaced by the Contractor with sound material, and the test shall be repeated until work is satisfactory to the District.

(E) LEAKAGE TEST. Immediately following successful completion of the pressure tests, each test section shall be subject to a leakage test pressure per subsection (C), which shall:

(a) Be of at least two hours duration;

(b) Not vary by more than ±5 psi for the duration of the test.

Rate of leakage shall not exceed the total computed from Table 305.06-2 corrected for number of joints under test:

TABLE 305.06-2
MAXIMUM ALLOWANCE LEAKAGE (Cubic Feet/Joint/Two Hours)
6-Inch Thru 48-Inch Nominal Diameter Pipe

Leakage Test Pressure (psi)	6-Inch	8-Inch	12-Inch	16-Inch	20-Inch
50	0.001533	0.002044	0.003066	0.004088	0.005110
60	0.001679	0.002239	0.003358	0.004478	0.005597
70	0.001814	0.002418	0.003628	0.004837	0.006046
80	0.001939	0.002585	0.003878	0.005171	0.006468
90	0.002057	0.002742	0.004113	0.005484	0.006856
100	0.002168	0.002891	0.004336	0.005781	0.007226
110	0.002274	0.003032	0.004547	0.006063	0.007579
120	0.002375	0.003166	0.004750	0.006333	0.007916
130	0.002472	0.003296	0.004944	0.006592	0.008240

Leakage Test Pressure (psi)	24-Inch	30-Inch	36-Inch	42-Inch	48-Inch
50	0.006132	0.007665	0.009198	0.010731	0.012264
60	0.006717	0.008396	0.010076	0.011755	0.013434
70	0.007256	0.009069	0.010883	0.012697	0.014511
80	0.007756	0.009695	0.011634	0.013574	0.015513

90	0.008227	0.010283	0.012340	0.014397	0.016453
100	0.008672	0.010840	0.013008	0.015175	0.017343
110	0.009095	0.011369	0.013643	0.015916	0.018190
120	0.009499	0.011874	0.015249	0.016624	0.018999
130	0.009888	0.012359	0.014831	0.017303	0.019775

Any portion of the section under test that fails the leakage test shall be repaired per this specification by the Contractor, and the section retested until approved at no additional cost to the District.

All visible leaks shall be repaired regardless of the amount of leakage.

(F) CHLORINATION. The Engineer will arrange for sterilization by chlorination of the main by the District during the leakage test.

The Contractor shall supply an adequate quantity of hydrated calcium hypochlorite powder for the chlorination process in accordance with the formula:

$$\text{Lbs. Powder} = \frac{11 \times (\text{In. Diam.}) \times \text{Ft. Pipe}}{1{,}000{,}000}$$

In. Diam. x Nominal Pipe Diameter

Ft. Pipe x Length of Pipe Under Test

The powder shall be sealed, moisture proof containers properly labeled and delivered to the Engineer at the start of the pressure test.

The Contractor shall provide access to any opening in the line to be used for sterilization and furnish assistance in chlorination and chlorine water flushing operations as part of the work.

(G) TESTING TIME PERIOD. For pressure and leakage tests, and chlorination of water mains, ten (10) consecutive calendar days have been included in "Contract Time".

If the time elapsed from the date when the water main is capped and readied for test until the date of its acceptance by the Engineer exceeds ten (10) calendar days, an extension of time may be granted upon Engineer approval.

305.07 MEASURE

The unit of measure for Ductile-Iron Pipe Water Main will be the linear foot, with measure taken along center line of pipe, including fittings, except Extra Fittings-Contractor Furnished, complete in place, with laying lengths of valves deducted. Reducers will be measured as pipe equivalent to the larger end size. When crossing a bridge, measure will also include pipe rollers, straps, and connecting hardware.

The unit of measure for Extra Fittings-Contractor Furnished will be the pound, as determined from the nominal tabulated weight of the fitting before the application of any lining or coating other than standard coatings). Weight of retainer glands, bolts, nuts and gaskets will not be measured. The weight of any fitting shall not be less than the nominal tabulated weight by more than ten (10) percent. No separate measure will be made for Extra Fittings - District Furnished.

305.08 PAYMENT

Payment for Ductile-Iron Pipe Water Main will be made at the Contract unit price per linear foot, which payment will include all joints and fittings (except Extra Fittings - Contractor Furnished), specials and closure pieces, harnessing, lining and coatings, additional tests subsequent to first test, installation of Extra Fittings - District Furnished, and all labor, materials, tools, equipment and incidentals needed to complete work specified.

Payment for Extra Fittings-Contractor Furnished will be made at the Contract unit price per pound, which payment will include all extra fittings and requisite retainer glands, gaskets, bolts, nuts and all labor, materials, tools, equipment, tests and incidentals needed to complete extra fittings work.

Payment for Extra Fittings - District Furnished will not be made. Payment for installation of District furnished fittings will be included in Contract unit price per linear foot for Ductile-Iron Pipe Water Main.

No separate payment will be made for air and drain blowoffs. Excavation required will be included in trench excavation; tees, bends, pipe, joints and standpipe will be included in water main work; 6-inch valve and valve casing(s) will be paid as separate items.

Two-inch wheel valve, caps and standpipe on dead end units shall be included as part of water main work.